HW:

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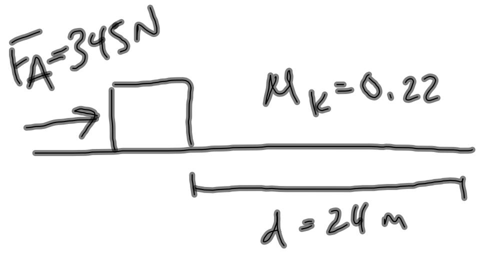
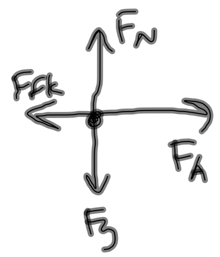
Energy Notes and Practice Problems 4.4.12 Honors Physics

A worker pushes a 1500 N crate with a horizontal force of 345 N a distance of 24.0 m. Assume the coefficient of kinetic friction between the crate and the floor is 0.220.
a) How much work is done by the worker on the crate?
b) How much work is done by the floor on the crate?
c) What is the net work done on the crate?





$\vec{F_A}$ $\vec{d}$ $\theta_1 = \emptyset^\circ$

a) $W_A = F_A d \cos\theta_1$

$= (345\text{ N})(24\text{ m})\cos(\emptyset^\circ)$

$= 8280\text{ J}$

b) $W_f = F_{fk} d \cos\theta_2$ $\quad \overleftarrow{F_{fk}}$ $\quad \vec{d}$

$= (330\text{ N})(24\text{ m}) \cos(180^\circ)$ $\quad \theta_2 = 180^\circ$

$F_{fk} = \mu_k F_N$
$= (.22)(1500\text{ N})$
$= 330\text{ N}$

$= -7920\text{ J}$

c) $W_{net} = W_A + W_f$

$= 8280\text{J} - 7920\text{J}$

$= 360\text{ J}$

Types of Energy: [Brainstorm]

Kinetic	Mechanical
Potential	Nuclear
Electric	Static
Audio	Magnetic
Thermal	Electromagnetic

Main Types of Energy:

1. Mechanical
   - Kinetic → car moving
   - Gravitational potential → elevator
   - Spring
2. Chemical → battery
3. Nuclear → stars
4. Electromagnetic
   - Electric
   - Magnetic
5. Thermal

Mechanical Energy:

- Kinetic → energy of motion
  - Equation:

$$\underbrace{K}_{\text{kinetic energy}} = \frac{1}{2} \underbrace{m}_{\text{mass}} \underbrace{v}_{\text{velocity}}^2$$

  - We sometimes care about changes in kinetic energy:

$$\Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

- Gravitational Potential:
  - Energy associated with height
  - Equation:

$$\underbrace{U_g}_{\text{grav. potential energy}} = \underbrace{m}_{\text{mass}} \underbrace{a_g}_{\text{accel. due to gravity}} \underbrace{h}_{\text{height}}$$

  - Sometimes care about changes:

$$\Delta U_g = m a_g h_f - m a_g h_i$$

- Total Energy:

$$E_{total} = \Delta K + \Delta U_g$$

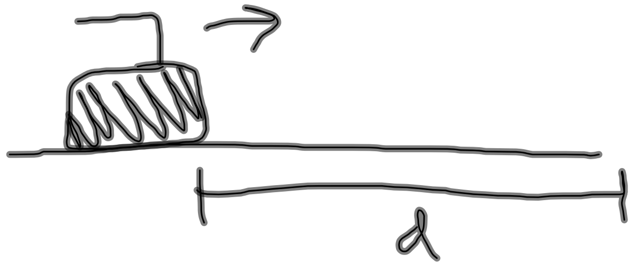
- Relationship between work and energy:
  - Work-energy theorem:

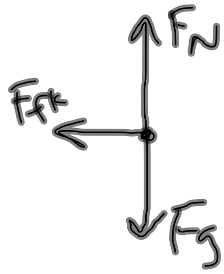
$$W = \Delta E$$

$$\boxed{W = \Delta K + \Delta U_g}$$

$$F d \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$$

On a frozen pond, a person slides a 10.0 kg curling stone, giving it an initial speed of 2.2 m/s. How far does the curling stone move if the coefficient of kinetic friction between the curling stone and the ice is 0.10?





$m = 10\ kg$ $\quad \mu_k = 0.10$

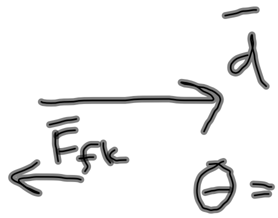
$v_i = 2.2\ m/s$

$v_f = 0\ m/s$

$$F_{fk}\, d \cos\theta = \frac{1}{2}m(\cancel{v_f^2}^{\,0} - v_i^2) + \cancel{mg(h_f - h_i)}^{\,0}$$

$$F_{fk}\, d \cos\theta = -\frac{1}{2}mv_i^2$$

$$d = \frac{-\frac{1}{2}mv_i^2}{F_{fk}\cancel{\cos\theta}^{\,-1}}$$



$\theta = 180°$

$$= \frac{-\frac{1}{2}(10\ kg)(2.2\ m/s)^2}{9.8\ N\ (-1)}$$

$$= 2.47\ m$$

$F_{fk} = \mu_k F_N$

$= (.10)(10\ kg)(9.8\ m/s^2)$

$= 9.8\ N$